

DEACON CHEMIST

NEWSLETTER

A Newsletter from the Chemistry Department of Wake Forest University

A Message from the Department Chair



Dear Friends,

It is my distinct pleasure to share with you the Chemistry Department's news and accomplishments from this past year. The lists are long and impressive, and many accomplishments are highlighted in this newsletter. For example, we can boast: 44 peer-reviewed manuscripts (5 with undergraduate student co-authors and 18 with graduate student

co-authors); a remarkable 87 seminars, contributed or invited conference talks, and/or poster presentations during the past academic year; service to the professional community including 108 manuscript reviews for 44 journals, 36 proposal reviews for 5 agencies, membership on 4 grant review panels and 8 editorial boards; degrees awarded to 6 chemistry graduate students and 29 chemistry majors (4 with honors) who will pursue careers or additional training in graduate or professional school to make advances in the field and in their communities; an 85% increase in the number of declared majors (up to 65 juniors and seniors) over the number of majors just three years ago; 51 undergraduate research projects completed; and across-the-board growth in chemistry class enrollments, with a total of 1450 students served by our lower-division courses alone.

But somehow lists of statistics alone can't do justice to one of the greatest values of this department – the collegial spirit of respect and cooperation fostered between faculty, staff, and students. To capture this, our lists would need to encompass the hours spent by department members – students and faculty and staff

alike - in the hallways of Salem Hall talking about challenging new scientific ideas, or the hours spent in our community sharing our love of chemistry and discovery, or the hours spent in meeting rooms deliberating about curriculum design and policy and planning. Although these many endeavors demand much of our time, they also reward us with the joy of sharing in one another's many successes – both personal and professional – and it is this genuine sense of responsibility towards one another and the institution that fuels our forward motion. Those who have passed through the department should know that their efforts have also contributed to our forward motion, and for this we are very grateful, not to mention hopeful that our associations will remain strong into the coming years of growth and change.

Sincerely,
Christa L. Colyer
 Department Chair & Associate Professor



Undergraduate Research Program Growing

Our undergraduate research program is on the rise. The last academic year we had 51 undergraduate research projects (up from 35 the previous year). May 2008 had 4 majors write and defend honors theses based on their research projects.

Our undergraduates, graduate students and ambitious faculty all collaborate on research and collectively are increasing our reputation for quality research. For instance, our department had strong representation at the 2007 Southeast Regional Meeting of the American Chemical Society (SERMACS) in Greenville, SC. In total, 19 department members were in attendance there (6 faculty,

11 grad students, and 2 undergrads), with 5 presentations by faculty, 13 presentations by graduate students, and 2 presentations by undergraduate students (with 8 undergraduate co-authors on presentations in total).

The chemistry department's outstanding track record in undergraduate research is mirrored in the University's focus on independent research and creativity. To promote undergraduate research and creative activity across the College of Arts & Sciences at Wake Forest and to foster and support collaboration among faculty and undergraduate students in their research and creative activity endeavors, the University established the

URECA (Undergraduate REsearch and Creative Activities) Center in 2008. The center will facilitate partnerships between faculty and, provide faculty with the resources to effectively mentor students and to develop collaborative relationships, provide incentives for students and faculty who engage in meaningful collaborations, organize and support campus-wide activities to showcase undergraduate research and creative works, including the annual Research Symposium. Chemistry is well represented in the URECA Center: Associate Professor **Rebecca Alexander** is a co-director and of the 62 posters presented at the Research Symposium on September 26, 2008, 9 were presented by undergraduates who conducted research in

the chemistry department. For more information on URECA and future events, see www.wfu.edu/ureca.



Weekly Seminar Series
 Join us each Wednesday!
 Schedule available at www.wfu.edu/academics/chemistry.

Meet Our New Faculty

2008 brought two new faces to Chemistry. **Lindsay R. Comstock** and **Patricia C. Dos Santos** are both biochemists who hold appointments as assistant professors in our department. While their research focuses are very different, they share an enthusiasm for teaching and mentoring students that makes them both a perfect fit for Wake Forest.

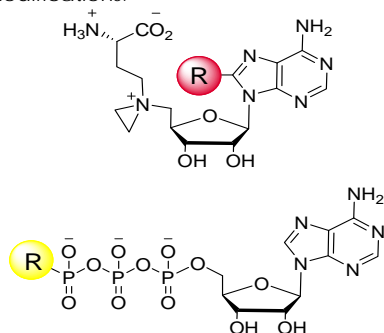
Lindsay Comstock received a B.S. in chemistry from Northern Arizona University in 2000. She then earned her Ph.D. in Pharmaceutical Sciences from the University of Wisconsin-Madison under Scott R. Rajski in 2005, where she synthesized methyltransferase-dependent DNA strand scission agents and demonstrated their utility as tools to identify sites of DNA methylation. She stayed at the University of Wisconsin-Madison and served as a post-doctoral researcher in the lab of John. M. Denu. There, she developed novel syntheses of several non-hydrolyzable analogs of O-acetyl-ADP-ribose, the novel metabolite of the Sirtuin family of deacetylases. These analogs were validated as mimics of O-acetyl-ADP-ribose using a variety of biochemical techniques and shown to hold great promise for future endeavors to identify the physiological role of O-acetyl-ADP-ribose.

Here at WFU, Lindsay's research efforts lie at the chemistry-biology interface. Her research group seeks to gain a deeper understanding of the role of post-translational modifications in the dynamic regulation of cellular function and how alterations in these modification states correlate to disease. A combination of organic chemistry, biochemistry, and molecular biology will be utilized to develop small-molecule tools to not only identify where substrates are modified, but to investigate the physiological effect of such modifications *in vivo*. This will be accomplished by synthesizing a novel set of cofactor mimics bearing ligatable



Lindsay Comstock

handles and employing cellular enzymes to transfer these unique functionalities to a variety of biological substrates. Ultimately, these easily-detectable functionalities on complex biological surfaces will serve as biochemical tools to begin understanding the underlying chemical driving forces which induce and alter biologically important processes and disease through post-translational modifications.



Analogues of S-adenosyl-L-methionine and adenosine triphosphate bearing ligatable functionalities (**R**) will be synthesized and evaluated as cofactor mimics of cellular methyltransferases and kinases.

Lindsay has also started classroom teaching. Her first teaching assignment this fall is Organic Chemistry II.

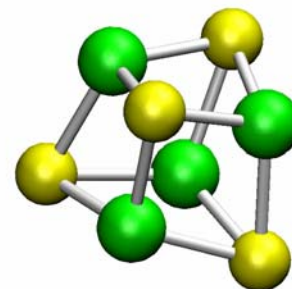
Patricia Dos Santos holds a B.S. in Pharmacy from the Universidade Federal do Rio Grande do Sul in Porto Alegre, Brazil. In 2001, she moved to Blacksburg, VA to pursue a doctoral degree in Biochemistry at Virginia Polytechnic Institute and State University. After completing her Ph.D. in 2004, she remained at Virginia Tech as an instructor of a molecular biology Honors class and as a post-doctoral research associate in the lab of Dr. Dennis Dean until joining the faculty at Wake Forest. This semester, she is teaching CHM 372, Protein and Nucleic Acid Structure and Function, her first class at WFU.

Patricia's laboratory at Wake Forest will focus on [Fe-S] clusters, biologically important chemical structures of iron and sulfur atoms. The importance of Fe-S clusters is intimately associated with the essential role of Fe-S proteins in a wide range of life sustaining processes including respiration, carbon



Patricia Dos Santos

metabolism, photosynthesis and nitrogen fixation. These chemical structures are organized in fundamental units of [2Fe-2S] and [4Fe-4S] clusters, or multimers, or fragments of these units. Although [Fe-S] clusters can be formed *in vitro* from their toxic components, almost all individual forms of life have developed specialized machineries dedicated to the assembly of these metal-centers. Dos Santos' group is interested in understanding the biochemical formation of [Fe-S] clusters in Gram-positive bacteria.



Understanding the biochemical formation of Fe-S clusters, such as the one shown above, is the focus of Dos Santos' research.

Please note an additional change in faculty status....

We are please to announce that Dr. Albert Rives, who has served as a visiting faculty member for the last six years has been appointed a Senior Lecturer in Chemistry. Al's notable accomplishments include coordinating the general chemistry labs and teaching a wide variety of courses, and we look forward to many years of his dedication, innovation and service.

External Funding

In the past year, 13 faculty members were involved in the submission of external grant proposals. 12 funded proposals yielded a total of \$1.6 M in external support to the department and institution. The following is a list of newly funded proposals:

The North Carolina Biotechnology Center awarded **Christa Colyer** \$75,000 for her project "Noncovalent Labeling and CE-LIF Strategies for the Determination of Intact Microorganisms".

Christa Colyer also received a 3-yr award, worth a total of \$386,000, from the National Science Foundation for "Affinity-based CE studies to facilitate bioprobe design and microbe detection."

Brad Jones received \$100,469 in joint funding from the National Science Foundation and the Department of Homeland Security for a project "A Portable Tungsten Coil Atomic Emission Detector for Nuclear Forensics". The project's goal is to develop a handheld field instrument that can detect and identify radioactive particles at a site of potential contamination, such as the terrorist detonation of a "dirty bomb". More information on

Jones' project appeared on *Window on Wake Forest* on Sept. 11. (<http://www.wfu.edu/news/release/2007.09.11.a.php>) and in the September 2, 2007 issue of the *Old Gold & Black*.

S. Bruce King (with Co-PI Dany Kim-Shapiro of WFU Physics) received a grant of \$50,000/year for two years from the National Institutes of Health for his proposal "Nitric Oxide Donor Compounds for the Treatment of Hemolytic Conditions". The major goal of this project is to develop new nitric oxide and nitroxyl donors that selectively react with cell-free hemoglobin for the treatment of hemolytic disorders.

The American Chemical Society also funded **S. Bruce King's** PRF proposal "Synthesis of Hydroxamic Acids through -NOH Insertion of Ketones" for \$100,000. This work will develop new synthetic methodology.

Mark Welker has received renewed National Science Foundation funding in the amount of \$378,000 for a three year cycle of research involving "Sequential Reactions of Main Group Element Substituted Dienes".

Blackbyrd Scholarship

Established in memory of Dr. and Mrs. Charles Black, the Blackbyrd scholarship provides an outstanding senior chemistry major with a scholarship. The 2007-2008 recipient of the **Blackbyrd Scholarship** is **R. Eric McAnally** ('09). Eric spent 10 weeks last summer at the University of Southern California participating in their REU program. There his work centered on methanol-to-olefin catalysis using zeolite structures. He has now joined Dr. Nofle's research group, and his current investigations of potential electrochemical synthesis routes to metallic-organic frameworks (MOFs) will serve as the basis of his Honors Thesis this spring. After completing his B.S. at Wake Forest, Eric plans on attending graduate school.

The department is appreciative of the support endowed scholarships, such as the Blackbyrd, afford our students, and looks forward to establishing more in the future, for both undergraduates and graduate students. We encourage alumni to consider endowing a scholarship in honor of the chemistry faculty member who served as their mentor.

Materials Science

The 08-09 academic year brought a new option to chemistry majors at Wake Forest University. For the first time, our department will offer undergraduate students a B.S. in Chemistry with a Concentration in Materials Chemistry. Developed along American Chemical Society guidelines, the rigorous program has students complete course and lab work in materials science along with the requirements for traditional B.S. majors. In support of the new program, the department received funding from the Provost's Capital Fund to allow the purchase of needed lab equipment. New instrumentation includes Raman and Electrochemical Impedance Spectroscopy and Scanning Tunneling Microscopy. **Ron Nofle** and **Abdou Lachgar**, who led the development of the new concentration, feel that the new focus will find a niche on our campus. This spring, Materials Chemistry lecture and lab courses will be offered for the first time.

NMR: Advancing Research & Teaching

Recently, the WFU NMR lab installed an automated sample changer capable of running 60 samples. The purpose of this investment, graciously provided by the department and the Provost's Capital Fund, was to complete students' cycle of synthesis and product evaluation. We are now able to run nightly NMR experiments on products from a complete lab section of 48 students. During the Fall 2008 semester, the

sample changer will run about 1,300 samples for Organic I and II, inorganic and physical chemistry classes. It will also help research labs become more efficient by running multiple samples during times when the machine would otherwise be idle.

So far NMR Manager **Marcus Wright** has seen this endeavor work on two levels. Not only are students assessing their synthetic skills, they are also learning to interpret spectral

data on their own products. We see this as a crucial skill as most of our students progress to professional schools and industrial careers. Another benefit the sample changer has provided is an increase in the much needed skill of self evaluation.

Later this fall a sample changer and computer control will be added to a gas chromatograph donated to the teaching labs by Bruce King's research lab.



Renovations Continue

Salem Hall continues to undergo renovations. The chemistry library renovation upgraded space into a Chair's office, an Undergraduate Study Room for use by our students, new Graduate Student office space and the new Chemistry Reading Room. The University has kindly loaned us art work from their collection for display in these new rooms. Be sure to check out our new space when visiting campus.

This summer the chemical prep room was upgraded with generous funding by the Provost's capital Fund. While not seen much by undergraduate students, this room serves as the preparation hub for all undergraduate teaching labs. It provides space for chemical storage, benchtop work, and fume hoods for making solutions. Experience gained from construction of Salem Hall's research laboratories was used to fully maximize allowable bench-top and storage space with minimal, albeit adequate, remaining floor space. The various needs of different teaching labs, from freshman to organic and liberal arts (non-science majors) chemistry, are met with specific electrical, plumbing, hood ventilation, and dispensing glassware storage. Multiple gas and air lines, and an automated lab glassware washing unit, have been added, with due regard to maintenance accessibility in the cabinetry and

ceiling. Mike Thompson, laboratory manager, says the new space is "...meant to be user-friendly for instructors and graduate students involved in undergraduate teaching labs, and to ... fully allow and therefore encourage the Faculty to concentrate on new ways to instruct and enlighten students."

Another necessary but less glamorous upgrade involves our department's solvent storage room. The former space did not meet current fire code. For more than six months, Chemistry has dispersed our solvent inventory around campus to be compliant with regulations while awaiting the completion of renovations to the existing facility. Thanks to financial support through the Provost's Capital Fund, this project is scheduled to be completed by the end of 2008.

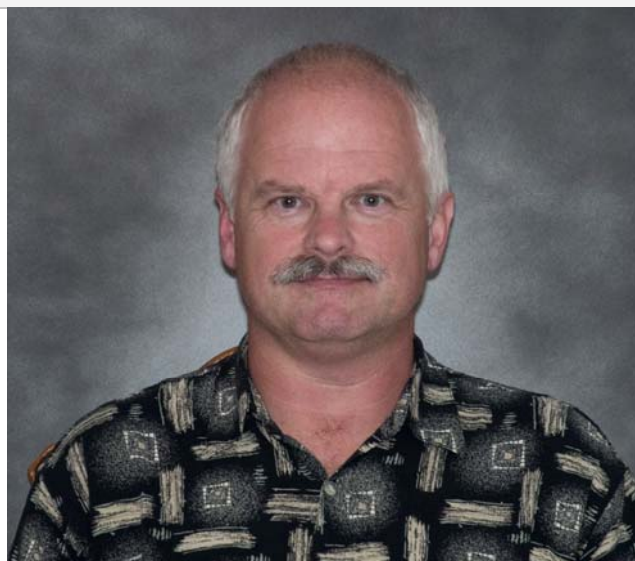


Laboratory manager Mike Thompson in the recently renovated lab prep room.

Staff Focus

If you haven't been to our departmental website recently, you should visit: www.wfu.edu/chemistry. It offers resources for not just our graduate and undergraduate students, but also organizes instrument scheduling, allows the local science community to preview our areas of expertise and seminar schedules, and gives the world access to chemical education resources developed here at Wake Forest. Keeping it running and up to date is no minor feat.

Maintaining the web page is just one of **Tommy Murphy's** tasks. As our department's Instructional Technology Consultant, Tommy is the go-to person for all things related to computers. From networking instruments and maintaining software to developing interactive tutorials and helping lab students navigate Excel, Tommy's calm demeanor and positive attitude help things go smoothly. To see examples of some of his final products, see <http://www.wfu.edu/academics/chemistry/courses/equilibrium/index.html> or <http://www.wfu.edu/chemistry/courses/periodic/index.html>.



Alumni News

Want to know what your classmates are up to? They do, too! Please send us a note where you are (kingag@wfu.edu or 336-758-5511) and we'll do our best to let others know in the next volume of *The Deacon Chemist*. Dr. Willie Hinze is also preparing a comprehensive chemistry alumni news listing.

1958

Patricia Curtis Huck (BS) earned a degree in Pharmacy (1977) from the University of Florida and recently retired as a Staff Pharmacist at the Holmes Regional Medical Center in Melbourne, Florida. Pat resides in Merritt Island, FL.

1962

Thomas L. Klechak (BS) obtained his Dental degree from the University of Maryland and MS in Orthodontics from North Carolina University. He served as Captain in the USAF Dental Corps 1965-1970 and was then a practicing Orthodontist for 33 years. Lew is very active in professional and civic affairs, having been the past President of the Jacksonville Dental, Florida Dental, and Florida Orthodontic Associations. In addition, he is past Chairman of the Jacksonville Downtown Development Authority and the Jacksonville Film & TV Commission. In October, 2004, Gov. Jeb Bush appointed Lew as the Chair of the Florida Film and Entertainment Advisory Commission. Lew resides in Jacksonville, FL.

1970

John A. Hyatt (BS) earned his PhD degree (1973) in organic chemistry working with Prof. J. S. Swenton at Ohio State University and then was a Postdoctoral Associate at Harvard

University working with Prof. R. B. Woodward. John then joined the Research Labs of Eastman Chemical Company in Kingsport, TN in 1975 and worked there as Research Fellow until his retirement in 2004. He then took the position of Research Professor (a half-time position) in the Department of Chemistry at East Tennessee State University in Johnson City. John was the recipient of the 1999 American Chemical Society Southern Chemist Award and Medal. He resides in Kingsport, TN.

1978

Candace H. Haigler (BA) received her Ph.D. in Botany (1982) from the University of North Carolina – Chapel Hill. She is currently Professor of Crop Science and Plant Biology at North Carolina State University. Prior to that, she was at Texas Tech University in Lubbock from 1986-2003 where she held the title Professor of Biological Sciences and Director, Electron Microscope Facility. Information on her current research interests is give at: <http://www.cals.ncsu.edu/plantbiology/Faculty/chaigler/chaigler.html>

1980

Walter G. Burkert (BS) has worked for the same company (now called Sun Chemical Corporation) since graduation. His area of focus is the development of water-based inks for paper and paperboard packaging. Walter serves (since 1994) as the Technical Director for this project. Walter and wife, **Vera Prelevic** (WFU MS in Chemistry, 1982) reside in Concord, NC.

1981

Susan Prugh Hagen (BS) earned her MS degree

(1984) from Iowa State University. She then worked for Pfizer Global Research for nearly 23 years in Ann Arbor, MI until the site closed in 2007. During her tenure at Pfizer, her research in the general area of therapeutics (anti-infectives) resulted in 44 publications, 3 book chapters, and 29 issued patents. She also worked on projects in quinolone antibacterials, non-peptidic HIV protease inhibitors, and new antibacterial classes. In 2006 she won an Award for Technical Achievement from the Organic Division of the American Chemical Society. Recently, Susan joined the University of Michigan Health Management Research Center, a leader in the study of health risk and behaviors, as a researcher and data analyst.

1982

Robert F. Crittenden (BA) is the owner of Roanoke Valley Wine Company (located in Troutville, VA), a wine importer and wholesaler that was founded by Rob and wife, Beth, in 1994, and operates in VA/WV/DC/SC. Information on the Company is given at: <http://www.rvwc.com>

1989

Timothy G. Costner (BS) earned his PhD degree in Analytical Chemistry (1993) from the University of South Carolina and then was employed as Analytical Superintendent at Clariant Corporation in Martin, SC. Currently, he is Group Leader/Senior Research Scientist in the Analytical Sciences Group with the Arizona Chemical Company in Savannah, GA.

1993

Henry Bryant (PhD) is employed as a Staff Scientist in the Diagnostic Radiology Department of the National Institutes of Health in

Bethesda, MD.

2001

Christopher L. Rector (BS) earned his PhD degree in chemistry (under the direction of Prof. Ned Porter) at Vanderbilt University, Nashville, TN [a photo of Chris and interview is given at: <http://www.vanderbilt.edu/AnS/Chemistry/students/rector.php>]. He is currently a Fellow in the Department of Pharmacology at the University of Colorado Health Sciences Center in Denver, CO.

2006

Jennifer Chu (BS) participated in the Japan Exchange and Teaching (JET) program in Japan for one year and in August, 2007 began her graduate studies at the University of North Carolina – Chapel Hill School of Public Health in the Department of Environmental Science & Engineering working towards her Master of Science degree in Public Health. Her research concerns water disinfection techniques, particularly UV light disinfection, and studying the disinfectant by-products (trihalomethanes, etc.) that form as a result of disinfection.

2006

Ashley N. Feneran (BS) is in medical school pursuing her DO degree (doctor of osteopathy) at Midwestern University's Chicago College of Osteopathic Medicine.

Faculty Awards and Distinctions

Several of our faculty currently hold faculty fellowships, acknowledging their research and classroom accomplishments. **Rebecca Alexander** is the Robert P. and Debra Lee Faculty Fellow, **Uli Bierbach** and **Christa Colyer** are Z. Smith Reynolds Foundation Faculty Fellows, **Brad Jones** is the Tatum Family Faculty Fellow, and **Abdou Lachgar** is the Bell Faculty Fellow.

Abdou Lachgar was also awarded a Research Professorship from the University of Nantes.

The 2008 WFU Excellence in Advising Award went to **Christa Colyer**, who has

thrived in the role of lower level adviser for many years and continues to serve in this capacity while department chair.

Dilip Kondepudi has published a new textbook "Introduction to Modern Thermodynamics", that is already in its second printing. More information on the text can be found at <http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470015985.html>. Dilip also received the WFU Excellence in Entrepreneurship Award for the development of a seminar, "Entrepreneurship and Sustainability". Congratulations to Professor Kondepudi for a very productive year!

Compounds made in the

lab of **Mark Welker** have been licensed by Strem Chemicals, Inc. and now appear in "New Products" section of their catalog. For more information see <http://www.strem.com/catalog/>.

In the last year, research in **Bruce King's** lab has generated a patent ("C-Nitroso-derived nitroxyl donors") and patent-pending ("Sulfenic acid-reactive compounds and their methods of synthesis and use in detection or isolation of sulfenic acid-containing compounds,") for a collaboration with Leslie Poole (Biochemistry) and Jacque Fetrow (Physics/Computer

Science).

Additionally, **Marcus Wright** and **Abdou Lachgar** were awarded a trade secret for their development of a catalyst for biodiesel production. More information of the WFU Biodiesel Cooperative, of which Marcus and Abdou are members, can be found online in volume 14 of the *Deacon Chemist*. See www.wfu.edu/academics/chemistry/volume_14_8-1-07.pdf.



Donors

The Chemistry Endowment provides interest income which allows us to update equipment and to offer increased educational opportunities at the graduate and undergraduate level. In addition to your regular donation to Wake Forest University, please consider a designated gift to the Chemistry Endowment. Such gifts can be used for endowed scholarships, teaching awards, and research support. The Department is genuinely appreciative of contributions made by our friends and colleagues this past year, which serve to enrich the research and teaching opportunities for our students, faculty, and staff.

Student Awards

Graduate student **Zhidong Ma** received the 1st-runner up prize in the basic science category for his poster presentation at the 2008 Wake Forest University Graduate Student Research Day. In all, more than 100 students participated in this year's event. Zhidong is advised by Dr. Uli Bierbach and his poster was titled "Tuning the Reactivity and DNA Interactions of Platinum-Acridine Hybrid Agents". **Zhidong Ma** also received the Graduate Student Presentation Award at the 2008 Cancer Biology Retreat. His presentation there was "Synthesis, Characterization, and Biological Studies of DNA-Targeted Hybrid Anticancer Agents".

Graduate student **Chris Junker**, a member of Dr. Mark Welker's lab, was selected to participate in the Central Europe Summer Research Institute (CESRI). This award, administered by the Institute of International Education and the National Science Foundation, provided support for Chris to conduct his research at the Faculty of Natural Sciences of Comenius University in Bratislava, Slovakia from

May 24 – July 12, 2008. His research, which is ongoing at WFU, focused on the effects of ultrasound and microwave irradiation on the Diels-Alder reactions of silicon-substituted 1,3-butadienes.

The **2008 John W. Nowell Award for Outstanding Senior Chemistry Major** was awarded to **Brian Blaker**. Brian ('08) is now a medical school student at the University of South Carolina.

May graduate **Will Birmingham** ('08) received the **2008 Hypercube Scholar Award**. Will conducted independent research under the direction of Rebecca Alexander and is now working on his Ph.D. in Biochemistry at Vanderbilt University.

The **2008 CRC Outstanding Freshman Chemistry Award** was shared by **Rebecca Harnish** ('11), **Elizabeth Kibler** ('11), **Charles Matthews** ('11) and **Kristy Tayapongsak** ('11). We look forward to watching their academic growth over the next three years. (See p.8 for picture)

Homecoming 2007



Prof. Baird, Rob Crittenden ('82) and Buck Cochran ('82) at the Homecoming reception



Dr. Baird, Chris Bramlett ('60) and Dr. Hamrick.



Dr. Colyer, Jennifer McCarthy Kindy ('00) and future Deacons.

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Fall/Spring Seminar Series

Join us each Wednesday!
Schedule available at www.wfu.edu/academics/chemistry

We're on the Web!

See us at:
www.wfu.edu/academics/chemistry

Outstanding Freshmen Chemists



Recipients of the **2008 CRC Outstanding Freshman Chemistry Award** (left to right) **Kristy Tayapongsak** ('11), **Charles Matthews** ('11), **Rebecca Harnish** ('11), and **Elizabeth Kibler** ('11) with Dr. Ron Nofle and Dr. Christa Colyer.

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